

Review Article

Empowering Economic Growth: The Transformative Impact of Electricity Access in ECOWAS and ASEAN Member States

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Abstract: Access to electricity is essential for a country's economic development since it paves the way for the growth of many different industries, businesses, and households. This study underscores the potential relationship between economic growth and access to electricity by examining the significant differences in economic development metrics between the member states of the Association of South-East Asian Nations (ASEAN) and the Economic Community of West African States (ECOWAS). From the 1960s to 2019, ECOWAS has lagged behind ASEAN regarding electricity access and economic growth, while ASEAN has experienced rapid and tremendous economic growth within the same period. By comparing their respective starting points in the 1960s, just after independence, to 2019, this study seeks to analyse the impact of electricity access on the economic development of the two regional blocs. The methodology employed in this study involves a literature review and analyses of secondary data from various sources. The study noted several challenges confronting ECOWAS in its pursuit to enhance access to electricity that could spur economic growth in the region. These challenges include, but are not limited to, poor infrastructure, affordability constraints, political instability, and high transmission and distribution losses. The findings provide valuable insights into the critical role of electricity access in spurring economic development and offer guidance on how ECOWAS can draw lessons from ASEAN's experiences to drive economic growth through enhanced and efficient increase in electricity access rates across its member states.

Keywords: Electricity Access, Grid Reliability, System Losses, Rural Electrification, Regional Integration

1. Introduction

Access to electricity is a key element for a country's economic growth and development. Electricity is indispensable for many industries, businesses, and households. It is perhaps the most widely used energy source in telecommunications, information technology, industry, and services. Electricity is, therefore, a key driver for job creation, industrialization, poverty reduction, and, ultimately, the economic growth of a country. West Africa is one of the world's poorest regions with low economic growth.

According to the World Bank, as of 2021, electricity access in sub-Saharan Africa, including West Africa, was about 50.60%, which is relatively low compared to other regions. The regional bloc, the Economic Community of West African States (ECOWAS), was formed in 1975 to address and define a course for the region's economic development, but it is yet to achieve the fast growth anticipated at its inception. ECOWAS is made up of fifteen (15) member states, the majority of which are low-income, with Gross National Income (GNI) per capita in 2018 ranging from \$452 in Niger to \$3,678 in Cabo Verde. This figure is alarmingly low

compared to the GNIs of many other parts of the world, and it is a source of concern for residents of the region, who tend to migrate to greener pastures in Europe, North America, and Asia. It is noteworthy, however, West Africa is well-endowed with natural resources such as crude oil, natural gas, renewables, uranium, and coal, which are used for power generation, and many studies have established a correlation between electricity use and economic growth [1-8].

The authors [9-11] have found a strong correlation between electricity consumption and economic growth. This relationship differed from one country to another. Twerefou et al [9] studied the causal relationship between energy consumption and economic growth in the West African subregion and discovered that petroleum and electricity use have statistically significant and positive effect on economic growth in the long run. The study concluded that in light of the long-run positive relationship between electricity use and economic growth, energy policy decisions should prioritize improving access to electricity. Odugbesan and Rjoub [11] using the autoregressive distributed lag (ARDL) Bounds test revealed a unidirectional causality from energy consumption to GDP for Indonesia and Nigeria, which are members of the Association of South-East Asian Nations (ASEAN) and ECOWAS, respectively. Bildirici [10] conducted a study on seven (7) countries, including three (3) ECOWAS member countries (Côte d'Ivoire, Nigeria, and Togo) and one (1) ASEAN member country (Brunei), emphasizing the impact of energy use policies on economic growth. According to the study, one factor contributing to African countries' poor economic growth is a lack of investment in energy infrastructure and services. Lee and Chang [12] studied the co-movement and the correlation between ASEAN countries' energy consumption and real GDP from 1971 to 2002. The findings revealed a positive long-run cointegrated connection between real GDP and energy consumption, indicating a long-run unidirectional causality going from energy consumption to economic growth. The period is critical to this study since it forms the period of significant economic growth in the ASEAN region, a few years after the independence of its member states from the same colonial masters who also colonized the ECOWAS region. It is worth noting, however, that other research have indicated that the traditional one-to-one mapping from energy consumption to GDP no longer holds true, particularly in industrialized countries, due to the use of more efficient equipment and sources of energy. Recent studies in the ASEAN region, have revealed complex relationships in the various countries, including unidirectional relationship running from GDP to energy consumption and vice versa due to the different stages of development in the region [9-15].

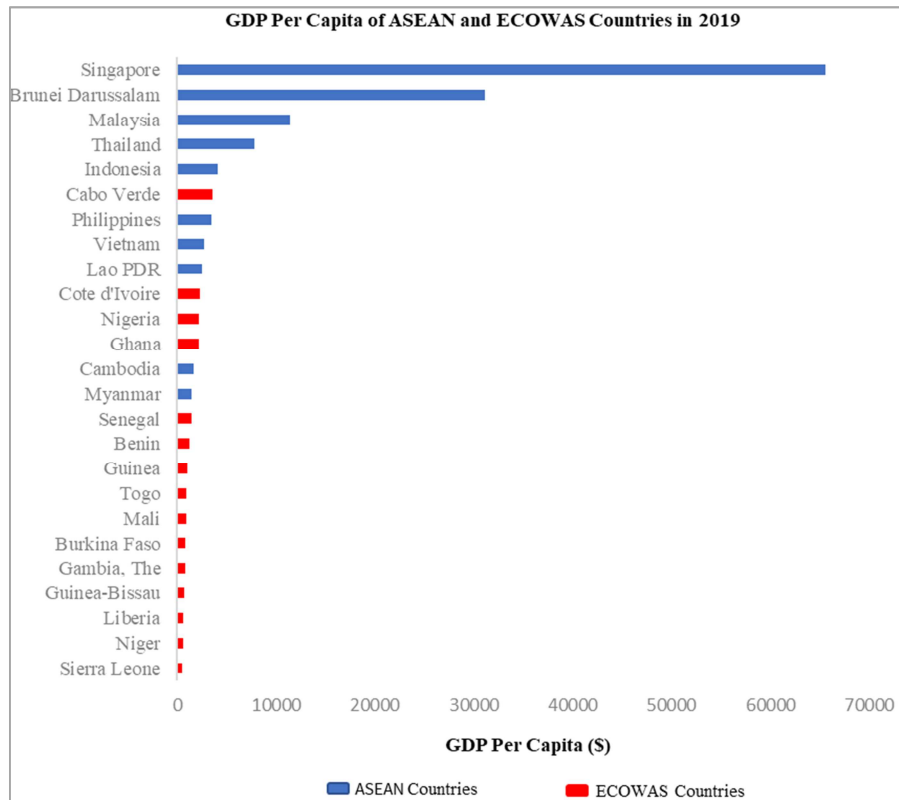
This study, therefore, seeks to compare the determinants of economic growth regarding electricity access and consumption in ECOWAS and ASEAN, which had comparable starting points at the time of independence, in order to determine if electricity access contributed to the ASEAN region's rapid growth over time. The ASEAN region,

comprising ten (10) countries, was chosen for this comparative analysis due to substantial similarities between members of these two regional blocs at the time of independence and the ASEAN region's present noticeable accelerated economic growth. ECOWAS is made up of Nigeria, Niger, Benin, Togo, Ghana, Burkina Faso, Cote D'Ivoire, Liberia, Sierra Leone, Guinea, Guinea Bissau, Senegal, Mali and Cape Verde and The Gambia. The ASEAN comprises Singapore, Vietnam, Malaysia, Thailand, Indonesia, Myanmar, Brunei, Cambodia, Lao PDR and Philippines. Consequently, the study seeks to answer the question, "How do two regional blocs with comparable starting points in 1960 have such disparate economic development outcomes over the next half-century?" The paper posits that energy use, especially electricity, is a core component of economic growth in the ASEAN region. The study's key question is, "Is electricity consumption a panacea for accelerated economic development?" What lessons can be learnt from ASEAN's to help drive economic growth in the ECOWAS region? The subsequent sections of the paper are structured as follows: Section 2 outlines the study's methodology. Section 3 provides a concise analysis of the initial circumstances in both regions post-independence. Section 4 offers an overview of the status of electricity access in ECOWAS and ASEAN. Section 5 delves into the insights gained and outlines the future trajectory of ECOWAS. The conclusion of the paper is presented in Section 6.

2. Methodology

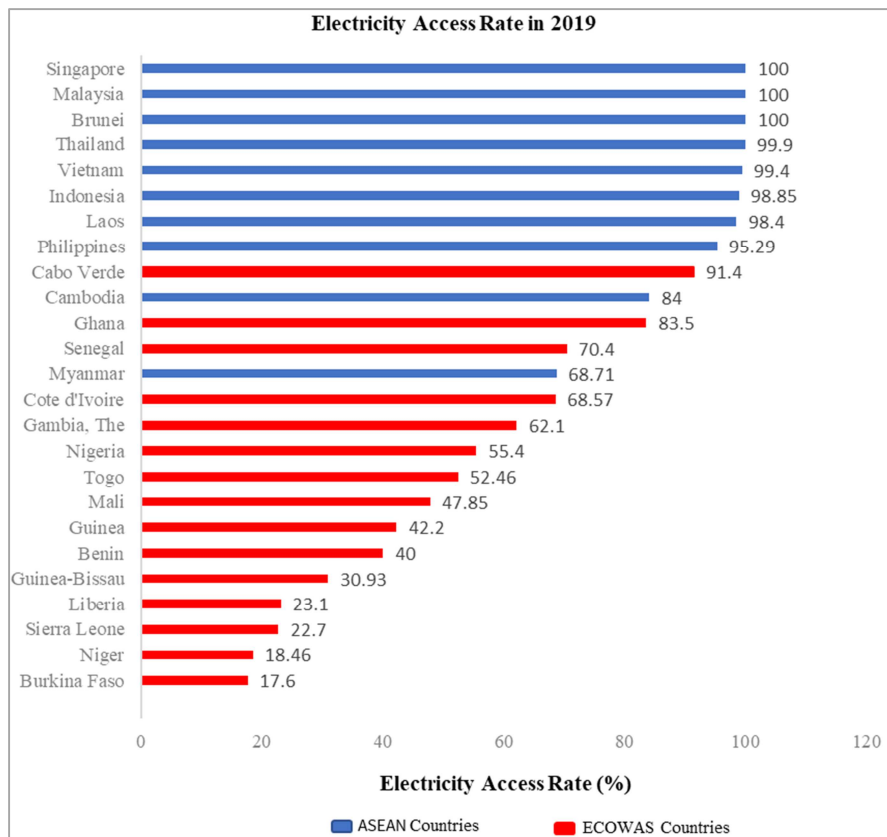
This study is based on a review of literature on energy and economic development in both regions, ECOWAS and ASEAN, as well as analyses of secondary data obtained from statistical reports and World Bank Development Indicators to find patterns in energy and economic metrics. Additional information was gathered from numerous publications, industry reports, government research reports, handbooks, and various power sector websites.

Furthermore, it is noted that ECOWAS is made up of fifteen (15) countries, while the ASEAN is made up of ten (10). Consequently, for a fair comparison between the two blocs, 10 ECOWAS member states were considered for this analysis, ranked from highest to lowest using 2019 GDP per capita, in order to exclude the effect of COVID-19. According to the 2019 GDP per capita of ECOWAS countries presented in Figure 1, Sierra Leone, Niger, Liberia, Guinea Bissau, and The Gambia had the lowest GDP per capita in 2019 and are thus excluded from the study. Aside from using 2019 statistics, the excluded countries have persistently trailed the rest of ECOWAS member states with respect to economic growth [2, 16, 17]. According to Figures 1 and 2, the GDP per capita and electricity access rate of ECOWAS countries are quite low compared to ASEAN countries, which forms the basis for this study; why, after more than a half-century, two different regional blocs with comparable starting points in 1960 have such divergent economic development outcomes?



Source: World Bank Development Indicators – GDP per capita [3]

Figure 1. 2019 GDP Per Capita.



Source: The Global Economy.com - Access to Electricity Country Rankings [18]

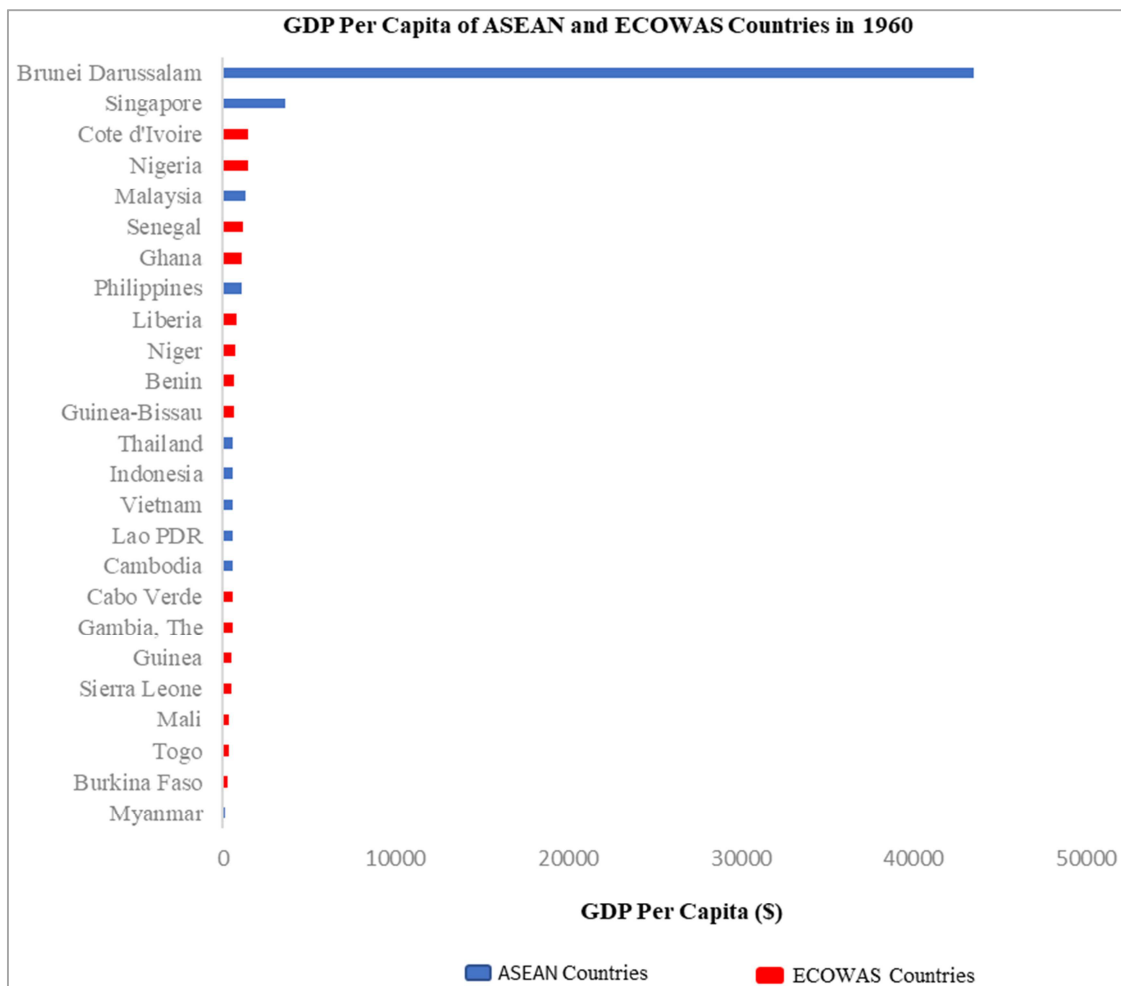
Figure 2. 2019 Electricity Access Rate.

3. Comparable Starting Points

ECOWAS is a 15-member regional body established on May 28, 1975, through the Lagos Treaty, to promote economic integration in all spheres of activity of the constituent countries. ECOWAS was formed to promote collective self-sufficiency among its member countries. Its purpose as a trading union is to build a single, significant trading bloc through economic cooperation. The proposed integrated economic activities revolve around but are not limited to, industry, transportation, telecommunications, energy, agriculture, natural resources, commerce, monetary and financial issues, and social and cultural issues. On the other hand, the ASEAN was founded on August 8, 1967, with the signing of the ASEAN Declaration (Bangkok Declaration) in Bangkok, Thailand. ASEAN is now referred to as an “economic tiger on the rise,” with a 450% increase in GDP from 2000 to 2017. ASEAN is a significant economic force,

ranking as Asia’s third-largest economy and the world’s fifth-largest economy economy in the world. The ASEAN area attracted substantial foreign direct investment (FDI) of US\$154.7 billion in 2018 [19-21].

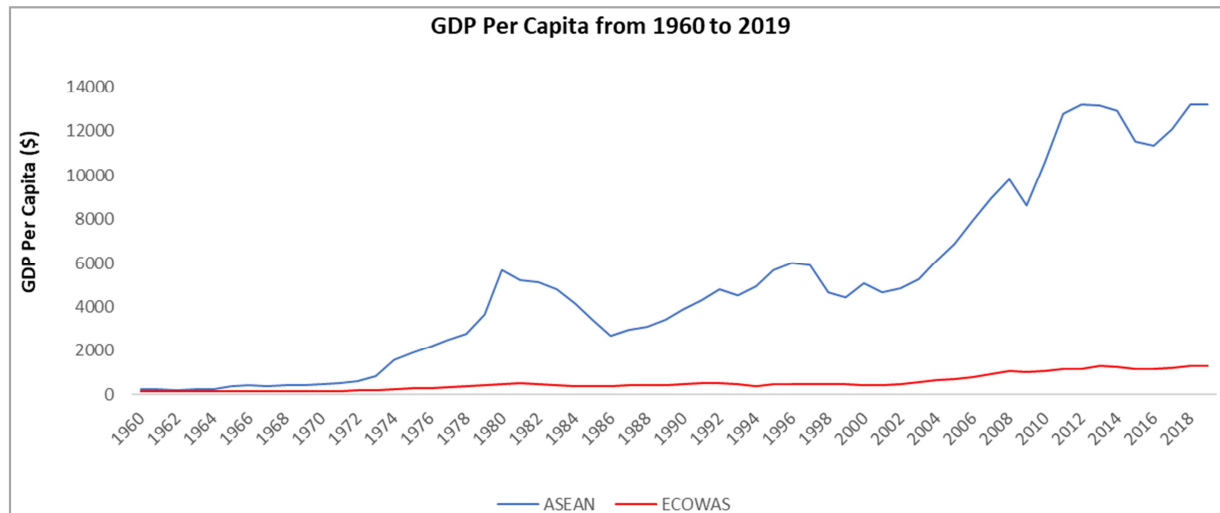
ECOWAS and ASEAN provide for a comparison of countries with striking parallels and differences. Most members of both blocs were colonized by the English, French, and other European countries until gaining independence in the 1960s, giving them a level playing field for economic development. Most ECOWAS members gained independence between 1957 and 1985, while ASEAN members gained independence between 1945 and 1984. Though it is difficult to determine how each country’s infrastructure differed at the time of independence due to a lack of primary and secondary data [22], Figures 3 and 4 show that members of both blocs had similar economic indicators at the time of independence or in the 1960s.



Source: Our World in Data - GDP per capita in 1960 [3, 23]

Figure 3. 1960 GDP per Capita.

Figure 4 shows that, from 1960 to 1970, the economies of the first ten ECOWAS countries based on 2019 GDP per capita were substantially similar.



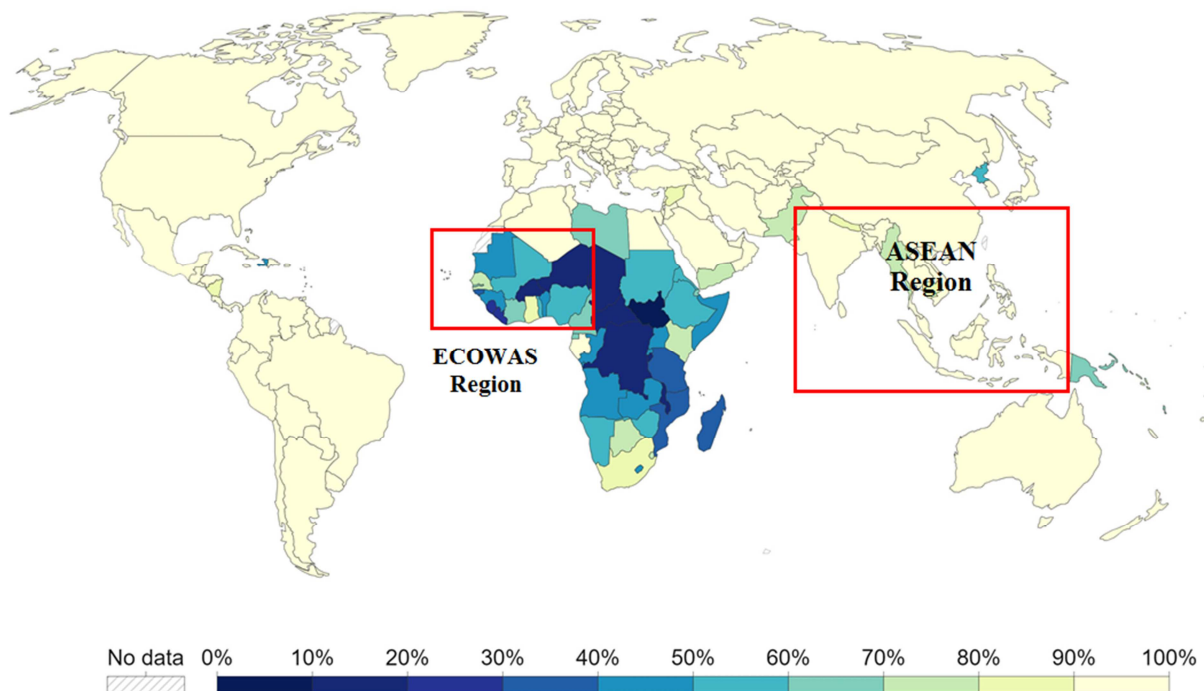
Source: World Bank Development Indicators – GDP per capita [3]

Figure 4. Trend of GDP per Capita from 1960 to 2020.

4. The Current State of Electricity Access in ECOWAS and ASEAN

According to the World Bank, access to electricity in Sub-Saharan Africa is a major concern, with only 50.6% of the region's population having access to this essential resource. The situation is even more concerning in the Economic Community of West African States (ECOWAS), where access to electricity is reduced to 42% of the population, while only 8% in rural areas. The low electricity access rate severely affects many

areas of life, including education, healthcare, and economic development. In stark contrast, the Association of Southeast Asian Nations (ASEAN) has made considerable progress in enhancing its population's access to energy. In ASEAN countries, an impressive 95.5% of the population has access to electricity, which has most likely resulted in substantial improvements in the lives of the people in these countries, allowing them to benefit from improved education, healthcare, and economic opportunities. Figure 5 depicts the global status of the electricity access rate, revealing that the ASEAN is undoubtedly more illuminated than ECOWAS [3, 18].



Source: Our World in Data – Energy Access [24].

Figure 5. Status of Global Electricity Access Rate.

4.1. Overview of Electricity Access Rate in ECOWAS

Several ECOWAS countries are struggling to provide reliable and affordable electricity. However, there have been efforts to enhance access to electrical power through initiatives such as the Rural Electrification Agency in Nigeria and the National Electrification Scheme in Ghana. Senegal, Mali, Togo, and many other ECOWAS countries have developed comprehensive plans to enhance access to electricity, with notable results. These programmes have positively impacted both small-scale industries and the quality of life in rural areas. These programmes have enabled entrepreneurs to start various businesses, including welding shops and agro-processing plants. As a result, job opportunities and revenue generation have increased. In Cape Verde, the government's concentration on renewable energy has increased access to electricity while decreasing reliance on fossil fuels. Cape Verde has emerged as a regional leader in renewable energy deployment by prioritizing clean energy sources. This move has attracted investments and aided in the formulation of a sustainable energy sector [25-29]. In addition to national efforts, regional integration, spearheaded by ECOWAS, is assisting countries in sharing resources and optimizing power generation through its specialized institutions such as the West African Power Pool, ECOWAS Regional Electricity Regulatory Authority (ERERA), and ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE).

4.2. Overview of Electricity Access Rate in ASEAN

ASEAN member countries have made significant progress in boosting electricity access in the region. The rapid rise in electricity access has been driven by diverse factors, including population growth, industrialization, and rural electrification, increasing installed capacity across the region. Singapore, Malaysia, and Brunei have achieved 100% electricity access through well-developed infrastructure and commitment to sustainability. Vietnam, Thailand, Indonesia, Myanmar, Cambodia, Lao PDR, and the Philippines have all made strides in increasing electricity access. Myanmar, Cambodia, Lao PDR, and the Philippines face infrastructure gaps and limited resources due to limited grid connectivity and aging infrastructure [30, 31].

Energy resources are abundant in Lao PDR, Myanmar, and Cambodia and are well exploited for consumption. Despite this advantage, these countries continue to struggle to grow their economy compared to other countries in the region, such as Malaysia and Singapore. The poorer countries of ASEAN, Lao PDR, Myanmar, and Cambodia have remarkable similarities with ECOWAS member states, including the prevalence of coup d'états, political instability, and weak grid infrastructure, all of which have detrimental effects on energy and economic policies. Figure 1 and Figure 2 show that access to electricity alone does not catalyze economic progress, as illustrated in the case of Lao PDR, which has near-universal

access to electricity and is a net exporter of electricity to more economically developed countries like Malaysia, Thailand, and Singapore. Instead, a balanced interplay of several elements, such as political stability, strong governance, and solid policies, is required to produce sustainable economic growth [32-34].

5. Lessons from ASEAN and ECOWAS' Future

The ECOWAS region's envisaged economic development is not sufficiently reflected in the increasing access to electricity in the region. While it is widely acknowledged that there is a strong link between economic activity and energy consumption, [35] examining data from 12 African countries from 1980 through 2010 found that Benin, Cote d'Ivoire, and Togo had high energy consumption levels that did not correspond to the low economic growth experienced in these countries during the same period. In comparison, ASEAN countries with near-universal access to electricity have higher GDP per capita than ECOWAS members. In terms of GDP, Cape Verde, which has near-universal access to electricity, competed favourably with ASEAN countries such as the Philippines and Vietnam in terms of GDP. Therefore, to some extent, it can be argued that electricity access is a driver of economic growth. However, while electricity can undoubtedly give several benefits, it is not a panacea that automatically leads to economic growth, as the case of Lao PDR demonstrates. Also, with higher electricity access, Ghana lags behind Cote d'Ivoire in terms of GDP. Therefore, there are various constraints to overcome in order to accomplish economic growth through increasing electricity access in the ECOWAS region:

5.1. Infrastructure Challenges and Reliability of the Grid

The reliability of electricity across ASEAN countries is contingent on multiple factors, including the availability and diversity of energy sources, the adequacy and efficiency of power generation, transmission, and distribution, the magnitude of electricity demand and consumption, the quality and stability of power supply, and the resilience and security of the power system [36]. The reliability of grid infrastructure within ASEAN exhibits notable variations among member states. Nations like Singapore and Malaysia have relatively robust and reliable grid infrastructure, attributed to substantial investments in both new installations and effective maintenance. Consequently, these countries experience fewer power outages. Conversely, certain ASEAN countries grapple with issues associated with aging infrastructure, inadequate investments, and rapid urbanization. Myanmar, Cambodia, and Laos, for instance, contend with more frequent power disruptions due to these challenges as shown in Figure 6 [36-38].

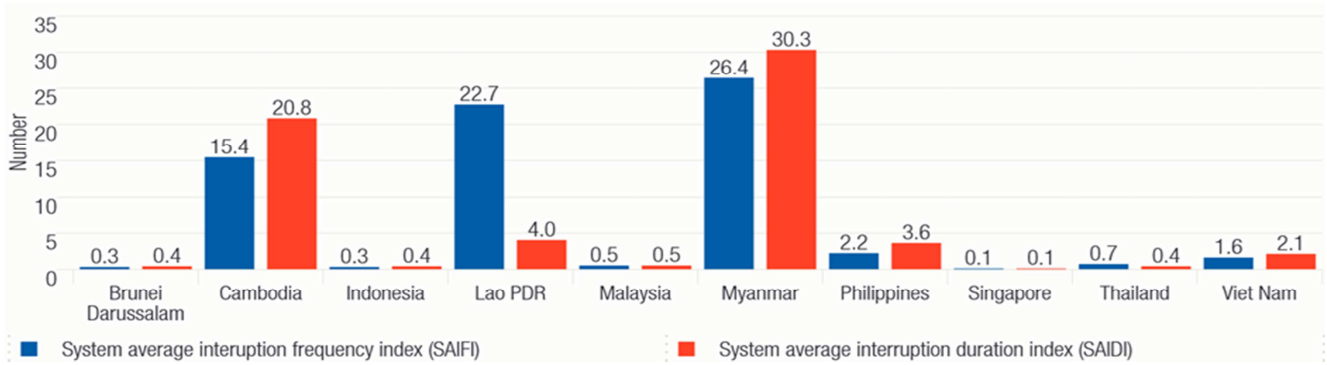


Figure 6. Frequency and Duration of Interruption in 2019 [38].

The electricity grid's reliability and infrastructure have long been a major concern for the ECOWAS region just like the poorer countries of the ASEAN region like Myanmar, Cambodia, and Laos. Regular power outages and erratic electrical power supply have caused significant disruptions and economic losses for businesses and households. Inadequate infrastructure is one of the key factors contributing to the grid's unreliability in West Africa. Many power plants, transmission, and distribution networks are obsolete and poorly maintained, leading to frequent breakdowns and system failures. Furthermore, a lack of investment to expand the grid's capacity has resulted in an overloaded system that cannot meet the growing electrical demand. Another critical concern is the high rate of electricity theft and failure to pay electricity bills. This denies utility companies their revenue and limits their capacity to invest in infrastructure upgrades and maintenance [39, 40]. To address this issue, ECOWAS must prioritize infrastructure upgrades and expansion investments. This comprises the construction of new power plants, installation of modern transmission lines and accessories, and the enhancement of distribution networks. It is noteworthy that simply providing electrical power connections to a load centre does not guarantee a consistent and reliable power supply.

5.2. High Cost of Electricity

Access to affordable and reliable electricity is crucial for promoting economic development and enhancing the quality of life in any region. Regrettably, West Africa has long grappled with high electricity bills, impeding progress and significantly impacting the daily lives of its population. A direct comparison of electricity prices between ASEAN and ECOWAS is complex due to various influencing factors such as market structure, generation mix, subsidies, taxes, exchange rates, and consumer categories. Nevertheless, based on available data from diverse sources, the average end-user tariff in ASEAN countries stands at approximately 13.5 US cents per kWh, whereas in ECOWAS countries, it is approximately 20.74 US cents per kWh. This indicates that electricity is comparatively more expensive in ECOWAS than in ASEAN, notwithstanding the lower income levels and purchasing power in the ECOWAS region. Within ASEAN, Laos has the lowest tariff at 3 US cents per kWh, while

Singapore has the highest at 24 US cents per kWh. In the ECOWAS region, Guinea has the lowest tariff at 7.7 US cents per kWh, while Liberia has the highest at 31.62 US cents per kWh. The main drivers of tariffs in both regions are the costs of generation. In general, countries that rely more on fossil fuels or imported electricity have higher tariffs than those that use more renewable energy or domestic resources. For example, Singapore imports most of its natural gas for power generation, while Laos exports most of its hydropower to neighboring countries. Similarly, Liberia depends heavily on diesel generators, while Guinea has abundant hydro potential [34, 41-44].

The ECOWAS region's heavy reliance on fossil fuels for power generation is a major contributor to the region's high electricity costs. West Africa relies largely on imported fossil fuels in this regard, making it vulnerable to price swings in the global oil market. As a result, the region is susceptible to volatility in energy prices and contributes to environmental deterioration and worsening climate change. Another significant challenge is the absence of competitive markets within the West African electricity sector. This shortcoming does not incentivize utilities to procure power at reasonable costs. Furthermore, weak power procurement policies exacerbate the problem, with persons with little experience in the power industry frequently negotiating Power Purchase Agreements (PPAs) on behalf of national utilities. This situation undermines the region's efficient and cost-effective power procurement processes. West Africa can improve energy security and reduce sensitivity to price volatility by diversifying its energy mix and reducing reliance on imported fossil fuels. Investing in renewable energy sources such as solar, wind, and hydroelectric power can also provide more sustainable and cost-effective choices for electricity generation. Furthermore, encouraging competition in the electricity market by implementing transparent and fair regulatory frameworks can incentivise innovation, enhance efficiency, and ultimately drive down costs. This can be accomplished by encouraging private sector participation and establishing a level playing field for all parties through unbundling the electricity supply value chain in member states [45, 46].

5.3. High Transmission and Distribution System Losses

In general, ASEAN nations, especially those with more advanced economies, such as Singapore and Malaysia, have

made substantial investments in modernizing their power infrastructure. This has led to lower transmission and distribution losses when compared to their counterparts in the ECOWAS region. The average system losses in ASEAN and ECOWAS stand at approximately 7.24% and 30.5%, respectively. High system losses during electricity generation, transmission, and distribution contribute considerably to West Africa's electricity access dilemma. Various sources contribute to these losses, including poor infrastructure, obsolete equipment, and insufficient maintenance. These problems dissipate electricity and impede efficient power delivery to consumers or end-users. Furthermore, illegal connections and power theft worsen the situation and result in financial losses for utilities. Exploring off-grid options as a potential solution, rather than exclusively depending on extending the grid to rural areas, could help significantly reduce system losses and enhance the overall reliability and efficiency of the transmission and distribution grids [40, 47, 48].

5.4. Climate Change

Climate change presents yet another serious hurdle for ECOWAS countries in improving electricity access for their members. Climate change's far-reaching and severe effects, such as regular droughts and catastrophic floods, can potentially alter power generation and delivery, worsening current issues profoundly. In light of this serious issue, tackling the problem of electricity access needs a significant emphasis on harnessing renewable energy sources with storage systems, which have proven to be more resilient in the face of climate change consequences [49]. As a result, fostering coordination and collaboration among West African countries becomes critical and indispensable to ensure efficient resource pooling, avoid unnecessary duplication of efforts, and ultimately pave the way for the region to have a sustainable and reliable electricity supply.

5.5. Policy and Regulatory Barriers

Weak and ineffective regulatory structures and ambiguous and inconsistent regulations produce an uncertain and challenging business environment. As a result, private sector participation in the power sector is discouraged, restricting investment prospects and stifling progress [40, 50]. ECOWAS should prioritize developing and implementing strong regulatory frameworks that promote healthy competition, assure fair pricing, and encourage private sector participation to overcome these impediments and generate genuine transformation. Member states can create enabling environments that attract private sector investments, drive innovation, and ultimately improve electricity access to consumers by streamlining administrative processes, establishing transparent and coherent regulatory frameworks, and fostering strong public-private partnerships.

5.6. Affordability and Socioeconomic Factors

Socioeconomic factors, such as poverty and income

inequality, play a significant role in creating disparities in electricity access. For many low-income households, the financial burden of paying for electricity connections or affording the cost of consumption can be overwhelming. These disparities in access to electricity can have far-reaching consequences, impacting education, healthcare, and economic opportunities.

In order to address these disparities and ensure that everyone has access to electricity, targeted interventions are necessary. This can include implementing subsidies or creating tariff structures that take into account the affordability constraints faced by vulnerable populations [40]. Additionally, it is crucial to promote income-generating activities and improve education and employment opportunities. These measures can help alleviate poverty and increase access to electricity for all population segments. High tariffs and limited income levels can prevent individuals and businesses from fully benefiting from access to electricity, inhibiting their ability to improve their quality of life and pursue economic opportunities. Therefore, it is crucial to address the challenges pertaining to the availability and affordability of electricity in the ECOWAS region and ensure equitable access that can stimulate economic growth in the region.

5.7. Obtaining Appropriate Skills and Education

Access to electricity does not guarantee the skills and knowledge required to take full advantage of its potential. Simply having access to electricity is insufficient to impact economic growth substantially. The ECOWAS region has a high illiteracy rate [40, 51]. Therefore, without the requisite skills and education, individuals will struggle to reap the benefits of electricity access if they are not adequately trained and educated on how to use it for beneficial purposes. Individuals must obtain the appropriate education and training in order to fully exploit the potential of electricity that spurs economic growth. By equipping individuals with the knowledge and skills needed to harness the power of electricity, they can transform their lives and communities. With the right training, they can utilize electricity to power industries, create jobs, and improve living standards. Education and training programmes that focus on the efficient and sustainable use of electricity can empower individuals to become innovators and entrepreneurs in their respective fields, leading to economic growth and development on a broader scale. Therefore, access to electricity must be coupled with the necessary education and training to fully capitalize on its potential and drive socioeconomic progress.

5.8. Complementary Infrastructure

To fully realize the benefits of electricity access, it must be complemented by other critical infrastructure components, such as well-maintained roads that connect communities and allow for efficient movement of goods and services. Furthermore, reliable communication networks are required to exchange information and ideas, enabling businesses to thrive

and individuals to connect with the rest of the world. These complementary elements are critical in unlocking the true potential of electricity access. They improve people's quality of life by enhancing access to essential services and fostering an atmosphere favourable for economic growth and development [52]. Without these complementary infrastructures in place, the transformative power of electricity will remain untapped, limiting the opportunities for growth and development. Therefore, policymakers and stakeholders need to recognize the interdependence of various infrastructure components and invest in their development holistically. Doing so will create a sustainable and prosperous future where access to electricity is complemented by a well-rounded infrastructure system, ensuring that the benefits of electrification are fully realized for the betterment of society.

5.9. Regional Integration

ASEAN recognizes the significance of grid interconnection in improving energy security and sustainability. The ASEAN Power Grid (APG) initiative aims to connect member states' power networks, allowing for the sharing of electricity resources and facilitating the integration of renewable energy. Several interconnection projects have been implemented as part of the APG efforts, including interconnecting Singapore and Peninsula Malaysia, Thailand and Peninsula Malaysia, Cambodia, Lao PDR, and Vietnam via Thailand. However, many future interconnection projects will require High Voltage Direct Current (HVDC) submarine cable interconnections. Figure 7 shows the APG Interconnected Transmission System with existing transmission lines and planned constructions [53, 54].

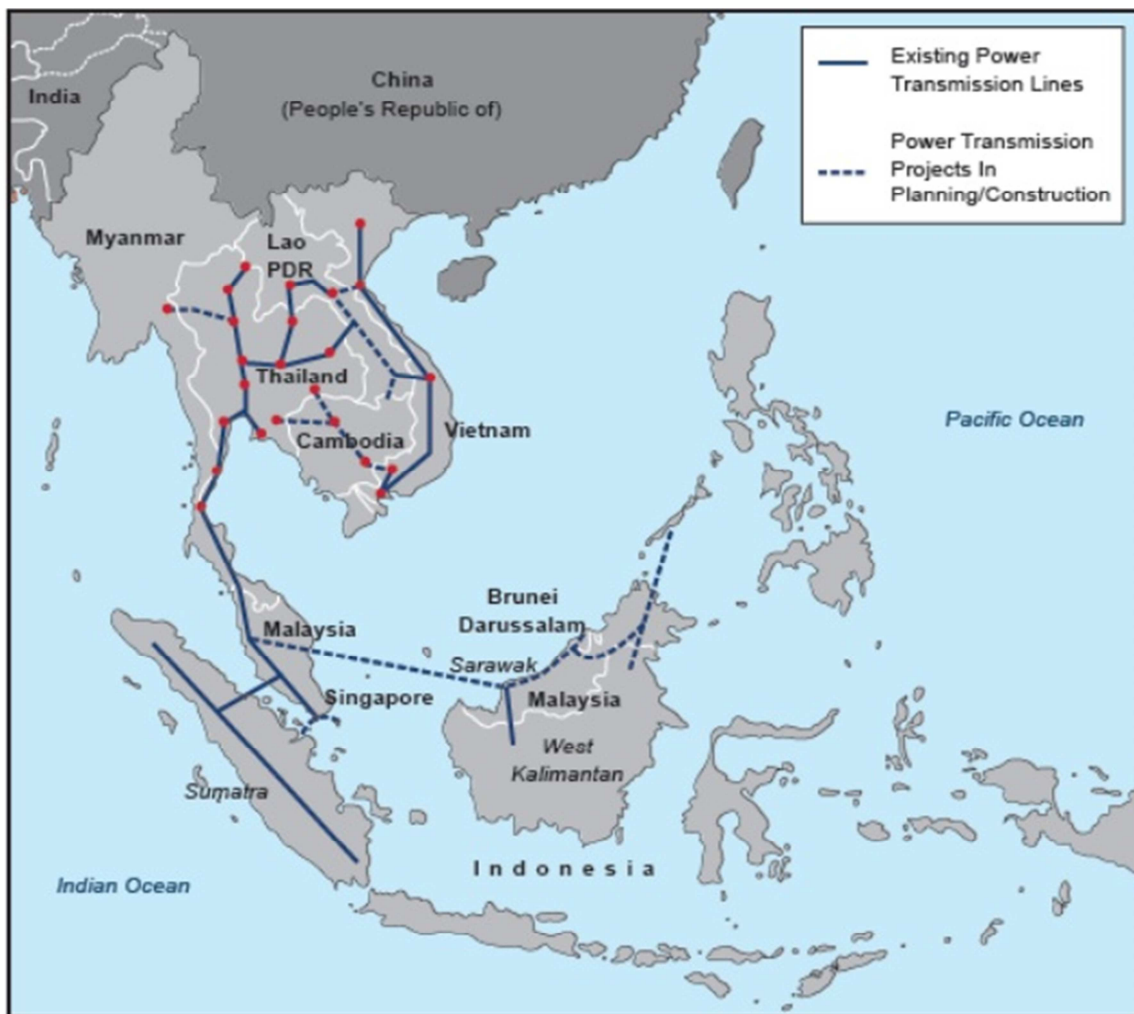


Figure 7. ASEAN Interconnected Power Grid [54].

Unlike ASEAN countries, ECOWAS members are primarily contiguous, allowing efficient resource sharing. As a result, ECOWAS has made progress in promoting grid interconnection among its member states. The West African Power Pool (WAPP) is a key initiative by ECOWAS to create a regional electricity market to facilitate cross-border

electricity trading. WAPP has completed a number of interconnection projects, including a 330 kV transmission line that connects Nigeria, Niger, and Burkina Faso. These projects have improved access to electricity and enhanced energy security and reliability in the region. However, a key impediment is a lack of harmonised regulatory frameworks

and technical standards among member states. This discrepancy impedes the smooth cross-border flow of electricity and raises transaction costs for market participants. To solve this issue, ECOWAS has been working through ERERA to harmonize legislation and build a regional

electricity market framework. These initiatives seek to create a level playing field for all stakeholders and stimulate private sector participation in cross-border trade. Figure 8 shows the WAPP Interconnected Transmission System, including existing and proposed transmission lines [55-58].

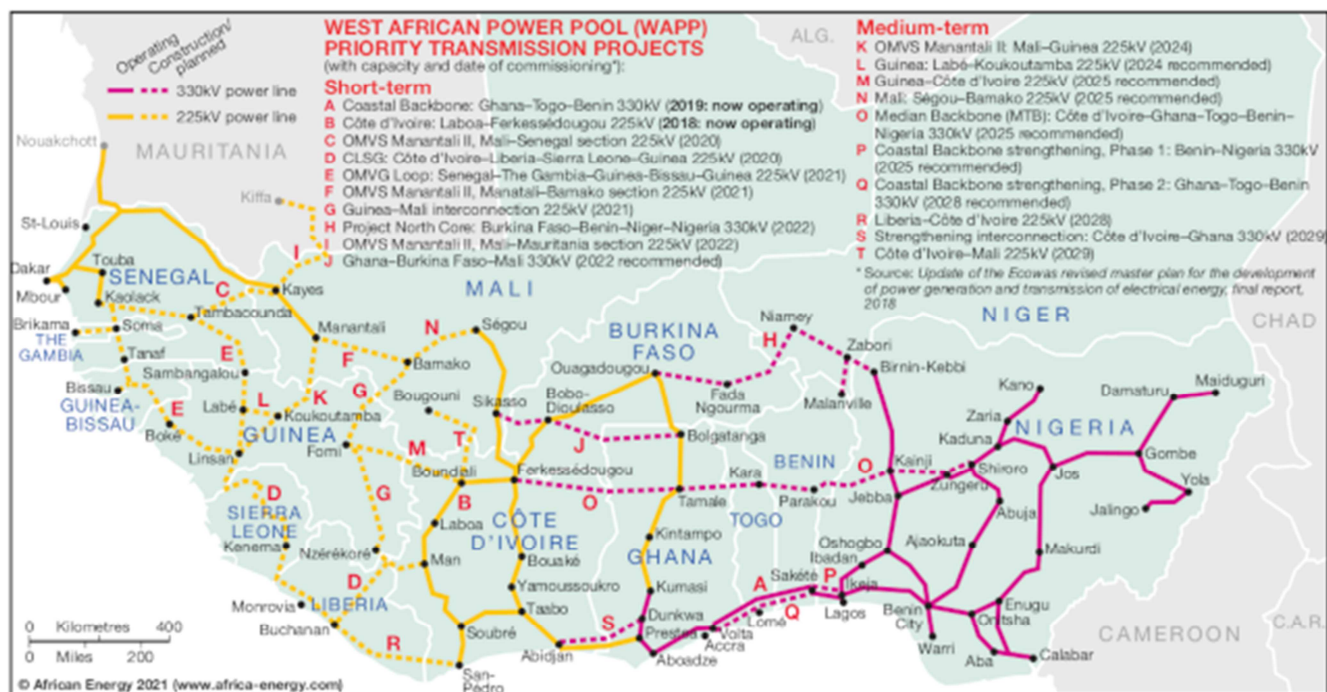


Figure 8. ASEAN Interconnected Power Grid [59].

5.10. Renewable Energy, Off-Grid Solutions and Rural Electrification

Renewable energy sources like solar, wind, and hydroelectric power provide a more sustainable and environmentally friendly alternative to fossil fuels. ECOWAS countries have abundant renewable energy resources, including abundant sunshine, high wind speeds, and large hydroelectric potential [60, 61]. By utilizing these resources, countries can lessen their reliance on imported fossil fuels and alleviate the negative effects of climate change and high electricity costs. The development of renewable energy projects creates jobs, attracts investment, and stimulates local economies. Additionally, decentralized renewable energy systems can provide electricity to remote areas not connected to the national grid, thereby improving energy access for rural communities.

Off-grid solutions and rural electrification, such as mini-grids and standalone solar systems, can play a crucial role in expanding electricity access in ECOWAS. These alternatives are essential in rural areas, where extending the national grid can be costly. Mini-grids, small-scale electricity distribution networks fueled by renewable energy sources, can supply reliable electricity to communities far from the main grid infrastructure [40]. For example, solar home systems and solar lamps can provide economical and clean energy alternatives for households and small enterprises. These

systems are easy to install, require minimal maintenance, and have the potential to significantly improve the quality of life for those who do not have access to electricity. Additionally, energy storage technologies are critical in rural electrification. Batteries and other storage systems allow excess energy generated during peak hours to be stored and used during periods of low generation or high demand. This assures a stable and reliable power supply, even in locations with intermittent renewable energy resources.

6. Conclusions

ASEAN and ECOWAS are two distinct regional blocs in different parts of the world, yet they share similar starting points regarding their economies. Both regions have worked over the years to increase economic cooperation, development, and electricity access across their member states. However, in terms of economy and access to electricity, ASEAN has surpassed ECOWAS. While it is indisputable that access to electricity has played an essential role in powering industries and raising living standards in ASEAN countries, it is noteworthy that access to electricity alone is not the panacea for economic progress in the ASEAN region. Improving economic development in the ECOWAS region would thus require a multifaceted approach that addresses the region's numerous concerns. ECOWAS can create a more conducive environment for businesses to operate and drive economic

growth of the region by promoting intra-regional energy trade, improving grid infrastructure, investing in education and training, promoting renewable energy, and strengthening regional integration.

Authors' Contributions

Data collection and analyses, and draft of the main manuscript, NKF; Methodology, review, and edit of the manuscript, RATA.

All authors have read and approved the published version of the manuscript.

Disclaimer

The views and opinions expressed in this article are those of the authors and do not reflect the official position of either ERERA or PURC.

Conflicts of Interest

The authors declare no conflicts of interest.

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